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by forest-clothed hills of pines, the streams flowing along quietly. The Dorè La will be found the best pass into the valley of the Kishen-Gunga. The ascent is gentle and open, and the road excellent the whole way into Kashmir, crossing the Raj Diangan Pass to descend on the Wuller Lake near Bunderpur.

IV.—*Reconnaissance Survey of the Lake Districts of Otago and Southland, New Zealand.* By JAMES M'KERROW, Esq., District Surveyor to the Province of Otago.\*

*Read, January 25, 1864.*

*Mountains and Lakes.*—The most marked and striking feature in the configuration of the country now under consideration, is the great and sudden differences of elevation that diversify its surface; the elevations take the form of mountain ridges, and the depressions that of gorges, valleys, and deep rocky basins, the latter filled by lakes. The mountains rise from 4000 to 9000 feet above the sea-level; and as the line of perpetual congelation is 8000 feet above the sea-level (as determined last year from the reconnaissance survey of the Wanaka and Hawea Lake district), it follows that all elevations greater than 8000 feet are within the glacier-producing zone. The highest parts of the Forbes and Humboldt Mountains are within this zone, and are covered with ice; they are parts of the great icefields that congregate around Mount Aspiring as a centre. The Earnslaw glacier, although only covering about a square mile in extent, is still, on account of its position, a very imposing object; it lies on the south side of Earnslaw, at an elevation of from 9000 feet down to the melting point; it is 15 miles north by east of the head of the Wakatipu Lake; and, as seen from any part of the most northerly 20 miles of it, is by far the most attractive object in view. The lie of the country is nearly from north to south; and while the mountain ridges individually range in that direction, they may, when taken in the mass, be more correctly described as lying from N.N.E. to S.S.W., and that being directly athwart the track of the almost constant winds from the Pacific Ocean, their influence on the climate of the country may be considered as of the highest importance; for not only do they break the force of these winds, but their cool tops condense the vapours into showers that might otherwise pass over so narrow an island without parting with a drop. The height of the ridges causes the downfall on them to take the form of snow, which lies on them during the greater part of the year; this circumstance,

\* The original Report appeared in the 'Otago Provincial Government Gazette,' Oct. 14, 1863.

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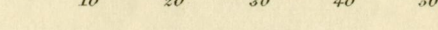
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Map of the Provinces  
of  
**CANTERBURY AND OTAGO**  
(NEW ZEALAND)

to Illustrate the Papers of

M<sup>r</sup>James M<sup>r</sup>Kerrow, D<sup>r</sup>J. Haast & D<sup>r</sup>Hector.

English Miles

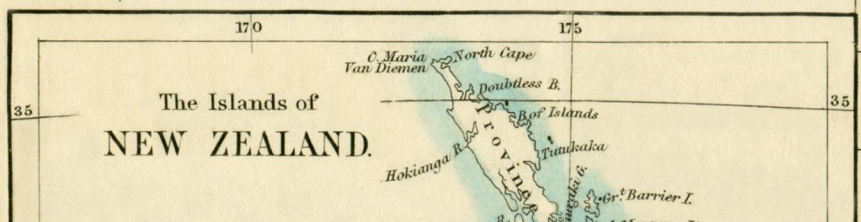


D<sup>r</sup> Haast's Journeys.....

D<sup>r</sup> Hector's Journey 1863.....











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by accumulating, over long periods, what would otherwise run off in streams as it fell, is the prime cause of the great, sudden, and, at first sight, apparently inexplicable floods that characterise all the rivers that have their sources in high mountains. Change of temperature is the secondary and immediate cause ; but although this is the case, a flood may occur without any great or perceptible increase of temperature, for the wind, by transporting the snow to a lower altitude, occasions the same effect as a rise of temperature. It was noticed, during the survey, that the snow-line on the north-west side (the windy side) of the mountain ridges was higher than on the south-east side (the sheltered side), thus showing that the wind is a very decided cause in producing the effects now under consideration. The flood-marks on the mountain streams, more especially those running into the Te Anau and Manipori Lakes, show a rise and fall almost incredible. The power exercised by such torrents is forcibly impressed on the attention by an examination of their channels, where immense blocks, that have in the first place been disintegrated from the surrounding mountains by frost, are seen lying and being broken up, through the never-ceasing attrition of rushing waters, into shingle and sand, which are carried forward and deposited in the lakes. The mouths of the rivers all show that they are advancing into the lakes, however slowly that may be. The lakes are a very great feature in the natural history of the country, and perform a most important function in its economy. They act as regulating reservoirs to the mountain torrents already mentioned ; for over their broad surface the floods find room to spread their volume, until there be time given for the accumulation to pass away in the steady flow of one river. The value of the lakes as a means of restraining such rivers as the Clutha and Waiau within safe limits, will more readily appear when it is considered that the Te Anau and Manipori Lakes (the two principal of the Waiau River system) alone cover 182 square miles, and that their surfaces have a rise and fall of 8 or 9 feet during the course of the year. The Clutha River, likewise, has the Wakatipu, 114 square miles ; the Wanaka, 75 square miles ; and the Hawea, 48 square miles : altogether, 237 square miles of lake to regulate its volume. These lakes have also a rise and fall of several feet. From the data now given, it will be evident that but for the tempering influences of the lakes, the Clutha and Waiau, in place of flowing along a well-defined channel, in a perennial stream as now, would have been so fluctuating in volume that no channel could have contained them, and their valleys would have been long shingle-beds down to the sea—a continuation, in fact, on a grand scale, of such valleys as those of the Dart and Matukituki.

The greater extent of the lakes at a former period is evident

from the terraces that surround their present boundaries; it is plain that the Wakatipu Lake must have extended formerly over the low fertile tract of country that extends east from Frankton to the Crown Ridge. The summits of Peninsula Hill, Morven Hill, and perhaps some of the lesser elevations, would then be islets. The old channel of a large river, leading away from the south end of the lake, at Kingstown, is very suggestive that then the overflow of the lake passed away by it, and down the Mataura to the sea. An examination of the valley in which this old channel lies, does not readily explain the cause of this rearrangement in nature, for no sudden upheaval has there dammed the waters of the lake back from their ancient exit; the old channel remains as distinct and as well defined as though the change had only been a thing of a few years. The waters of the lake have receded rather more than a mile in distance, and left the old channel high and dry. The very abrupt gorge through which the Kawarau (the present outlet of the lake) flows, suggests that the change has been brought about by the sudden erupting force of an earthquake opening a pass through the mountains lower than the level of the then lake; and that the present deep gutter-like channel of the Kawarau has been the subsequent slow and gradual wearing down of the channel by the rapid current that sweeps along it.

The depth of the lakes is an interesting consideration in connexion with them. I had not the means of determining it; but that their depth may be reckoned by hundreds of feet, I have almost no doubt. On leaving the shore, at the distance of a boat length or two, the bottom may be seen through the clear water at a depth of 20 or 30 feet; but there is then very often a sudden dip, and there begins the deep blue water through which the eye can no more penetrate. Up the Fiords of the Te Anau and Manipori Lakes there are many places where there is no beach at all; the rocks rise perpendicularly out of the water for hundreds of feet, so that it may be said there is a precipice above and a precipice below the surface of the water. If the waters of the lakes were suddenly to dry up, the present shore-line would, I believe, appear in most places as a mere ledge on the face of a precipice. On the Wakatipu Lake, one of Mr. Rees' boatmen tried the depth of the lake near Queenstown: by means of a weight attached to the end of a rope, 200 fathoms of line were let out before reaching what was considered to be the bottom; similarly, on the Wanaka Lake, 70 fathoms were let out. These results, although they cannot be relied on as precise, are of value as showing how very deep the lakes must be. Soundings of the lakes, carefully taken with deep-sea sounding apparatus, would aid in the solution of the problem—"By what means were the lakes produced?"

The recent development of inland navigation has directed at-

tention to the fickle and uncertain winds that prevail on the lakes. This phenomenon is accounted for on the principle in pneumatics that underlies the explanation of all motions in the atmosphere, viz., the tendency of cold air to supply the place of the warmer and more rarefied. The secondary causes are the unequal radiating powers of land and water, and more especially, in this case, in the very unequal and mountainous surface of the country surrounding the lakes; the cold mountain air descends into the gullies, and they all open into the lakes. Then, again, they lie in different directions, and so receive the heat of the sun at different times of the day. The consequence of these varied influences at work is a condition of unstable equilibrium in the atmosphere, which, when intensified by a strong north-west wind (the prevailing wind) raises a sea on the lakes that—confined within their narrow limits and broken on many headlands and islands—becomes for the time a tumultuous assemblage of waters, against which it is in vain for human effort to contend. The action of the winds on the Te Anau Lake, from its greater size and diversity of shape, is more interesting than on any of the other lakes. On it there is sometimes both a storm and a calm at the same time. Sometimes it will blow down the lake, and at the same time be calm up the fiords, or *vice versâ*. When such is the case, there is a sort of heaving motion over the calm part. During warm settled weather the phenomenon of “land and sea-breeze,” so grateful in warm countries, prevails on the lakes. On the Te Anau Lake, where, on account of the large extent of downs on its east side, the radiation is more regular than that which arises from the surroundings of some of the other lakes, this alternating breeze during the intervals it operated was seen to be so regular, morning and evening, that it became almost a measure of time; and from the tidal effects that the breeze had on the Te Anau, it seemed to confer on it the attributes of a sea.

*Rivers.*—The two principal rivers of the country surveyed are the Waiau and Kawarau; these, together with the Upper Oreti and Wakaia, represent the drainage of the country. The Waiau issues from the Te Anau Lake, and after a very rapid sinuous course of 10 miles, it enters the Manipori Lake at a distance of  $5\frac{1}{2}$  miles in a direct line from its exit from the Te Anau; after mingling its waters with those of the Manipori Lake, the Waiau leaves it at a distance of 6 miles south from where it entered it. For the first 5 miles of its course, after leaving the Manipori Lake, the Waiau flows east by south in a slow sluggish manner; at that distance it receives the Mararoa, a very considerable tributary; it then suddenly bends to the south, and at the same time quickens its current; it then pursues a rapid course of upwards of 40 miles, in a general direction very nearly due south, when it falls into the

sea. The Waiau receives in its course, from the west side, the Borland, Monowai, Dean and Lillburn, in the order named ; and similarly from the east the Mararoa, Wairaki, Orawea, and many smaller streams ; each of the streams just named is of considerable size, and two of them, the Mararoa and Monowai, may be classed as rivers, and will yet be noticed as such further on ; still, so far as appearances indicate, there is no very perceptible increase of the Waiau after leaving the lakes ; it seems to issue from them full-grown ; its average breadth is 150 yards, its depth may be from 10 to 20 feet, and the rate of current, after being joined by the Mararoa, from 4 to 7 miles an hour. Judging of the volume of rivers by the extent of country drained by them, the Waiau would be rated at rather more than one-third of the Clutha. In this case, however, I think, from causes already mentioned, that there will be greater precipitation on the western watershed of the Waiau than on some of the watersheds of the Clutha, many of the latter being secondary ridges of mountains in the interior ; if so, then there will have to be an allowance made in favour of the size of the Waiau.

The Mararoa takes its rise by means of two branches in the Livingstone Mountains, which unite together about half a mile above the North Mavora Lake. After flowing due south through the Mavora Lakes for 9 miles, the Mararoa for the next 18 miles of its course flows in a south-west direction through a finely-grassed and well-wooded valley ; it then bends to the west a little north of the boundary line between the Otago and Southland provinces ; for the next 10 miles of its course it runs nearly due west, running off and on the boundary line during that distance ; it then receives the Whitestone Creek, a very considerable tributary that takes its rise near Snowdon, and has a south-west course of upwards of 20 miles through the Te Anau Downs. The Mararoa, after receiving the Whitestone, suddenly bends to the south, and after a further course of 6 miles s.s.w. it joins the Waiau about 4 miles south of the boundary line. The total length of the Mararoa from its most remote source to its confluence with the Waiau is 56 miles.

The Monowai is the outlet of the lake of the same name : the length of the river is 6 miles, and its direction E.N.E. ; it joins the Waiau 12 miles below the confluence of the Mararoa. It was in the middle of November I saw the Monowai ; it was then nearly a chain wide, and was from 18 inches to 2 feet deep, and had a current of not less than 5 miles an hour ; the Monowai Lake must, therefore, receive the drainage of a very considerable extent of country to the west of the Hunter Mountains. This country, as seen in the beginning of November from the summit of Hindley and from Ardeer Peak, appeared to be very high and mountainous ; all the peaks seen were covered with snow.

The Wairaki, Borland, Dean, and Lillburn are streams of from 10 to 20 miles in length ; they are all dependent on snow, more or less, for their supply, and being so, they are very fluctuating in size.

The other tributaries of the Waiau, not yet mentioned, are those running into the Te Anau and Manipori Lakes ; the principal are the Upukerora, Eglinton, Clinton, Worsley, Glaisnock, Doon, and Spey. The Upukerora takes its rise in the Dunton Forest, to the east of the Dunton Peaks, and after a south-west course of upwards of 20 miles it bends suddenly to the north, and after running in that direction for more than a mile it falls into the Te Anau Lake at Patience Bay. The Eglinton takes its rise by two branches from the mountains that bound the head of Milford Sound ; they unite below the east side of Mount Eglinton, and after flowing for several miles through a deep wooded gorge the open country occupied by Mr. Hodge is entered, and after a further course of 8 miles the Eglinton falls into the east side of the Te Anau Lake. Its general course, from where its branches join to its mouth, is south-west. The Clinton, like the Eglinton, takes its rise from the watershed of Milford Sound ; its general direction is south by east ; it enters the Te Anau Lake at its east head. A boat can be taken up the Clinton for  $1\frac{1}{2}$  mile, and after that it is only 16 miles to the head of Milford Sound. The Worsley rises near Castle Mount, and flows down a deep wooded gorge, east by south, to the west head of the Te Anau Lake. The Glaisnock enters at the head of the north fiord of the Te Anau, after flowing in a south-east direction down a narrow, steep wooded gorge. The Doon has its rise near Mary Peaks, and only a few miles from the head of Caswell Sound and George Sound ; it flows in an E.S.E. direction along a narrow, flat, wooded valley of about one-third of a mile in width to the head of the south-west arm of the middle fiord of the same lake. The Spey has its rise from the watershed of the West Coast, near the heads of Jail Passage and Breaksea Sound : for the greater part of its course it flows east by north through a very precipitous gorge ; on emerging from it the Mica Burn joins it, and, after a further course of nearly 2 miles through a narrow wooded valley, the Spey falls into the head of the west arm of the Manipori Lake.

The Kaware is the issue of the Wakatipu Lake : it leaves the lake at the base of Peninsula Hill, its exit is obstructed by masses of rock that divide its volume into several parts that take the form of falls when the lake is high. For the first mile or two of its course the current of the Kaware is sufficiently slow to admit of cattle swimming easily across it, afterwards it becomes more rapid ; at the distance of nearly 3 miles from the lake it is joined

by the Shotover, and at a further distance of 6 miles by the Arrow. Its general direction up to this is east by north ; it then bends towards the south, and at the same place enters an abrupt rocky gorge, through which it has a very tortuous course of 18 miles before entering the Clutha Valley. After a further course of 5 miles through it, the Kawarau joins the Clutha just before the latter enters the gorge of the Dunstan Mountains. The general direction of the Kawarau is from west to east ; its confluence with the Clutha is nearly due east of where it leaves the Wakatipu Lake ; the distance in a straight line is 23 miles, following the course of the river it will be 32 miles. The Kawarau drains about the same extent of country as the Upper Clutha River, and, as in this case the nature of the watershed is similar, they may be considered as of nearly equal volume at their junction. So great a body of water as the Kawarau possesses would, in favourable circumstances, have been of service in the inland navigation of the country, but there are various obstacles in connection with this river which render this impracticable : these are the rapid current, the narrow and tortuous channel, and the reefs of rocks which cross the channel at several places, besides at its exit from the lake.

The rivers that contribute principally to the Kawarau are the Dart, Rees, Greenstone, Von, Lochy, Shotover, and Arrow ; of these the first five flow into the Wakatipu Lake.

The Dart is considerably the largest of the tributaries just mentioned ; it issues in one stream from a deep wooded gorge west of Earnslaw, and at a distance, in a straight line, of 16 miles nearly due north of the head of the Wakatipu Lake, into which it flows ; the bearing of the gorge and the size of the river there both indicate that it has its sources on or about the boundary-line between Otago and Canterbury. The glaciers of the Forbes and the Humboldt Mountains are situated on the opposite sides of the Upper Dart. That its supply depends almost entirely on melted snow and ice is evident from the great fluctuations that characterise its volume. Immediately below the gorge the channel widens out to a shingle-bed of from half a mile to a mile wide ; this breadth is maintained on to the lake, a distance of 20 miles by the river. During the survey, the river ran over this shingle-bed in several streams ; but flood débris showed that it is sometimes all covered.

The Rees enters the head of the Wakatipu Lake only a few yards east of the Dart. Like the latter, it also issues from a wooded gorge, at a distance, in a straight line, of 16 miles N.N.E. from the head of the lake. It has its upper sources in the ice and snow fields of the Forbes and Richardson Mountains. The flat

part of its valley presents similar appearances to the Dart, though on a less scale, for that river is about three times the size of the Rees.

The Greenstone takes its rise by two branches, viz. the M'Kellar and the Caples. The M'Kellar branch, according to Mr. David M'Kellar, who explored its head sources about three years ago, "takes its rise near the head of Milford Sound, and after flowing through two small lakes and a considerable extent of bush, enters an open, narrow valley." It flows down this valley in a nearly straight line for 10 miles in a S.S.E. direction; it then bends at right angles, and after forcing its way through a very narrow gorge for 6 miles in an E.N.E. course, it is joined by the Caples branch from the N.N.W. The united Greenstone then flows in an easterly direction for nearly 2 miles before entering the west side of the Wakatipu Lake.

The Von is formed by the union of two branches, each about 9 miles in length. The south branch issues from the Eyre Mountains, and the north branch from the Thomson Mountains; they unite in a deep dell on the south side of Mount Turnbull, and after a course of 9 miles in a north-east direction, through a finely grassed valley, the Von falls into the west side of the Wakatipu Lake.

The Lochy, by means of several branches, drains the barren region enclosed by the Eyre Mountains. Its length is about 15 miles, and general direction east by north; it falls into the Wakatipu Lake at Halfway Bay.

The Shotover ranks next to the Dart of the rivers that are tributary to the Kawarau. It takes its rise in the ice and snow fields of the Richardson and Harris Mountains, and, as these are its principal sources, it attains to near its full size early in its course. This is for the first 15 miles south by east, then 8 miles south-west to the junction of Stony Creek, then 9 miles south in a general direction to Arthur's Point; it there leaves the mountains, and at the same time bends to the east for 3 miles, and then again south by east for other 3 miles, before joining with the Kawarau. On its west side it receives the famous creeks—Skipper's, Stony, Moonlight, and Moke (united)—in the order named. The Shotover, during the greater part of its course, is so hemmed in by opposing mountains that its banks are impassable in many places for either man or horse. The confined nature of its banks and the snow-clad watersheds sufficiently explain the sudden and overwhelming floods that characterise it. The incessant action of the river along one course for ages has cut out its bed into an abrupt gutter-like channel. This, mechanically speaking, may account for the rich auriferous deposits found in the bed of the Shotover; for, as the river kept deepening, the banks would slip into it as

into a great sluice-box, where, coming under the action of so powerful a current, the gold would be washed out and deposited, while the lighter matter would be carried away.

The Arrow takes its rise from the snow on Mount Hyde, and after a crooked course through a succession of deep gorges, during which it receives several tributaries, all known to be highly auriferous, it emerges into the open country at Arrowtown; and after a further course of 6 miles along the base of the Crown Ridge, it joins the Kawarau. The distance, in a straight line, from the most remote source of the Arrow to its mouth is 15 miles; the course by the river will be a few miles more, and its general direction is south by east.

The Oreti rises in the Thomson Mountains; for the first 22 miles of its course it runs parallel to the Mavora Lakes and the Mararoa River, at a distance from them of 2 to 4 miles; for the next 5 miles of its course it runs nearly due south, when, being joined by the Windley from the Eyre Mountains, it enters Southland after a course of 27 miles in Otago, the latter 17 miles being through a well-grassed valley.

The Wakaia takes its rise by several tributaries from the Rocky Mount and the Obelisk. It enters the Wakaia Forest, and after flowing through it for 8 miles it enters a fertile well-grassed valley, through which it meanders for 18 miles in a south-west direction. During this part of its course the Wakaia receives on its south side the Argyle Burn from the Umbrella Mountains; and on its north side the Gow, Steven, Steeple, Dome, and Garvie Burns from the Garvie Mountains. After receiving the Garvie Burn, the course of the Wakaia is nearly due south for 7 miles to its junction with the Mataura. The total length of the Wakaia will be upwards of 40 miles. At its confluence with the Mataura it is nearly of equal volume with that river.

*Pasture.*—There are 1635·8 square miles of pastoral country, of which 778·5 square miles belong to the country drained by the Waiau and Upper Oreti, 552·3 to the Kawarau, and 305 to the Wakaia. The grass-land occurs in detached portions, and under a variety of circumstances that render a detailed description necessary. Beginning with the Waiau District, the country on the west side of the Waiau River will have to be noticed firstly. The extent is 86 square miles, and consists principally of terrace-flats along the banks of the Waiau, which yield natural grasses abundantly, the nutritive qualities of which were very evident from the prime condition of the stock depasturing on them. On the south banks of the Monowai, and up the valley of the Lill, this district is diversified by the undulations of low ridges: these are much overrun with scrub that will yield generally to the clearing effects of burning off. There are, however, at the head of the

Lillburn several square miles covered with dense prickly scrub and bog-pine shrub, that would be almost impervious to fire, owing to the want of grass below to carry the flame along and through it. The Waiau River is a great hindrance to the traffic to and from this district. There is considerable risk in swimming cattle over, and as for sheep, they have all to be boated across. This disadvantage is compensated, I think, by the quiet so desirable in sheep-farming, and isolation from the contagion of epidemic disease. During the survey, while the stockowners on the east side of the Waiau were in the greatest dread of their flocks becoming contaminated by contact with a diseased flock in that district, those on the other side of the river had no apprehension from the same cause. Another advantage worth notice is, that the river and bush outline so fence in these runs, the one from the other, that the duties of shepherding the flocks are very considerably less than in open country. The small parklike patches on the west side of the Waiau, near its exit from the lakes, although apparently of little consequence from their smallness, are much valued by the stockowners for the paddock accommodation they furnish to the male portion of their flocks at certain seasons of the year. The clear at the base of Paddock Hill is peculiarly valuable for this purpose on account of its being bounded on the north side by the sluggish part of the Waiau, so that there is no difficulty in crossing and re-crossing that river at this place.

The remaining part of the Waiau District comprises 692·5 square miles of pastoral country, of which 429·5 belong to Otago, and 263 to Southland. The Southland portion lies between the Takitimo Mountains on the east, and the Waiau River on the west, and is south of the boundary line between the provinces. The Otago portion is wholly to the north of the same line, and embraces the Te Anau Downs, the Upper Oreti and Mararoa Valleys. The surface is diversified by the descending spurs of the Takitimo Mountains, by several extensive flats along the courses of the rivers, and of low undulating ridges over the Te Anau Downs. It is all very well grassed; blue tussock is the prevailing sort of grass, and oatgrass, anise, and other herbage is frequently met with. Excepting the higher parts of the Takitimo Mountains, a very considerable part of this country is under the elevation of 1000 feet above the sea-level. The Te Anau Downs may be stated as having a mean elevation of 1100 feet, and the Mararoa Valley rises to 2000 feet at Hamilton's Station. Around the north side of the Te Anau Downs and Mararoa Valley the forest covers the spurs of the mountains, so that the pastoral country is almost all under the highest of the elevations just named; it therefore may all be considered as free from snow during the whole course

of the year, so far as the safety of stock is concerned. It only remains to be mentioned, that under this portion of country there is also included the Mararoa Valley, above the Mavora Lakes. This part of the valley, from the head of the Mavora Lakes to the Pongburn, is, for an average breadth of 2 miles, covered with as fine pasture as any part of the valley lower down; but from its high elevation, being nowhere less than 2100 feet above the sea-level, and rising from that till it merges into barrenness, near the source of the Mararoa, it is almost certain to be under snow for some time during winter.

The pastoral country drained by the Kawarau may next be noticed. Its extent is 552·3 square miles, lying principally around the Wakatipu Lake, and the valleys leading into it. Beginning at the head of the lake, and coming down the west side, there is no pastoral country till the mouth of the Greenstone is reached; there, on a terrace-flat, are found a few hundred acres of fine pasture. Continuing down the lake from the Greenstone 9 miles of a very rugged steep incline, covered with fern, is passed over before the valley of the Von is reached. This valley is several miles wide; it encircles Mount Nicholas and Pasture Hill, and runs back for 15 miles in a south-west direction, when it blends with the Oreti and Mararoa Valleys; the whole forming one continuous well-grassed, well-sheltered valley, between the Wakatipu Lake and the Te Anau Downs, of a height nowhere greater than 2600 feet above sea-level, and falling from that elevation on both sides to the level of the lakes. After passing the mouth of the Von Valley, the mountains again rise abruptly from the lake and leave little room, between its margin and the line of barrenness, for vegetation. The valleys of Collin's Bay and Halfway Bay unite together by a low saddle behind Bayonet Peaks, and make up between them several thousand acres of very fair country. South of Halfway Bay the west side of the lake rises precipitously, and, with the exception of some straggling scrub amongst the rocks, is entirely barren. Returning to the head of the lake, and coming down its east side, there will be (including the valleys of the Dart and Rees) 91 square miles of pastoral country gone over before reaching Fortune Cove; it consists of the spurs from the Richardson mountains, and of considerable flats at the head of the lake, and around Mount Alfred. This is all well-grassed, and is capable of bearing a large amount of stock throughout the year; for, from the fact of there being a large proportion of low country, not much over 1000 feet in elevation, there will always be abundance of feed during winter in the valleys when the higher parts are under snow. It is a considerable drawback to this country that, except by boating, there is no ready means of access to it,

there being no beach along the lake at several places. The only way of driving stock off or on is by crossing the mountains near Moke Lake, at an elevation of 6000 feet; the track can only be taken by sheep, and that of course only when the snow has disappeared.

After passing the precipitous coast-line west of Fortune Cove there begins a stretch of low country extending along the margin of the lake for several miles. It consists of terrace-flats and of hills sufficiently low to be grassed over their summits. It reaches back to the Moke Lake, and then along the Moke Valley behind Ben Lomond to a junction with the Shotover Valley. Its extent, together with the Shotover and Arrow Valleys, and the low country extending east from Queenstown to the Crown Ridge, is 149 square miles. The valleys of the Shotover and Arrow have little or no flats. The mountain spurs running down to them descend from elevations of from 5000 to 8000 feet in so very steep and rugged a manner that, considering the broken nature of the country and the barrenness of its higher parts, not more than one-half of the extent has been classed in Table A as pastoral country. The low country extending east from Queenstown to the Crown Ridge is much the best, not only of the quantity now immediately under consideration, but also of the whole Lake District. It is an undulating extent of 20,000 acres, containing several large flats and one or two considerable hills. The whole is covered with a thick growth of grass, and is certainly entitled to rank with the very best pastoral country in the province. This country would, from affording a safe retreat to the flocks in the winter-season, have been of essential service in developing the pastoral resources of the higher parts of the Shotover and Arrow Valleys; but, as things now are, it has become a commonage for the large number of horses employed in packing, &c., on the Gold-fields.

Of the country lying around the Wakatipu Lake, that only remains to be mentioned which extends down the east side of the lake from Queenstown to Kingstown, and from thence down a valley of 6 miles in length to the Mataura River; the extent is 134 square miles. The low part of this country consists of the valley just mentioned and several thousand acres around Peninsula Hill. The high part consists of the slopes of the Hector Mountains and the ridges of the Eyre Mountains, drained by the Robert and Allen Creeks. The high and low parts of this division of the country bear a fair proportion to one another, and are so situated that the one develops the other.

The Wakaia Valley contains 305 square miles of pastoral country. The surface consists of a terrace-plain of alluvial flats, and of low, long ridges that flank the sides of the Garvie and

Umbrella Mountains. The lower part of this valley, from its dryness and the large extent of fine hill-pasture, is especially well adapted for sheep. Towards the head of the valley, where the flat part narrows into a mile wide, there is a tendency to wetness in the soil along the banks of the river; this circumstance, together with the fact of there being patches of manuka-scrub on the ridges, render this part of the Wakaia best fitted for cattle-runs.

*Agricultural country.*—The low elevation of the Waiau Valley naturally suggests its fitness for agricultural settlement. This, however, with the exception of the Waiau Plain is not the case. The flats on the west side of the Waiau are generally too shingly, and the country between the Takitimo Mountains and the Waiau too uneven for cultivation. Still there are several earthy spots of a few hundred acres each, scattered pretty equally up and down in the valley, suitable for that purpose. Around Mount York there will be about 20,000 acres of alluvial soil, to the cultivation of which there are no natural hindrances. It lies principally towards the Manipori Lake, and up the banks of the Mararoa and Whitestone, and will be from 600 feet to 1000 feet above the sea-level.

The agricultural country lying around the Wakatipu Lake consists of about 10,000 acres at the head of the lake, a few hundred acres at the mouth of the Von, and 10,000 acres lying east of Frankton; the latter quantity consists of a terrace-flat between Frankton and the Shotover, and of several alluvial flats between the Shotover and Arrow. The elevation above sea-level will be from 800 to 1100 feet. This elevation in some situations would have a bleak effect, but any tendency that way, as regards this country, is counteracted by the high mountains that encircle it; for, not only do they afford shelter, but the radiation of heat from them has at times, I believe, a very sensible effect on the increase of temperature. Be that as it may, I have no doubt, taking the climate and fertility of the soil as they are, that either cereals or vegetables would, if properly attended to, grow well and arrive at full maturity.

*The Wakaia.*—The whole of the flat of this valley, including an area of 70 square miles, may be classed as agricultural land; the terrace-plain, comprising one-half of it, would perhaps be too dry some seasons for cropping; to the other half, lying principally along the banks of the river, no such objection could be urged, some of it would require to be drained, for which there is plenty of fall.

*Forests.*—A reference to Table A will show that there are 959·2 square miles of forest. This belongs principally to the valleys of the Waiau and its tributaries, and consists of what is usually known

(according to the kind) as red, black, and white birch,\* red and black pine, and totara. The birch is much the most common tree of the forest; it was found to have a vertical range of at least 3400 feet, for it was seen a few feet above the sea-level, and then again it was found to be growing over a dip in the Hindley Ridge, at an elevation of 3400 feet above the sea-level. At the latter elevation the stems of the trees were of a zigzag unsymmetrical form, and the general appearance of the trees was squat and stunted. The other sorts, viz., black and red pine and totara were seen to be principally in the Dean Forest, at a low elevation, and within a vertical range of a few hundred feet. A sprinkling of them was seen in the forests along the shores of the Te Anau and Manipori Lakes. In the same locality, the tutu-tree, fuchsia, and numerous other shrubs flourish; and, by the variety of their foliage and brilliancy of blossom, contribute very considerably to the charms of the lake scenery. Up the valley of the Dart, totara was met with; on Pigeon Island, Wakatipu Lake, totara, pine, and goa; and in the Island Bush, Te Anau Downs, totara and pine, at elevations ranging between 1000 and 1400 feet. On Goldie Hill, totara and red pine were seen to flourish at an estimated elevation of 1700 feet; generally, however, for all elevations over 1000 feet, the birch is the tree of the forest. So far as this survey is concerned, I believe it will be an under-estimate to state that the birch occurs five times for one of all the other sorts put together. Seeing that so large a portion of the province is covered with this tree, it is interesting to know that so far as applied to economic purposes, it is found to answer well; the stock-owners use the black birch extensively for fencing, stockyards, &c. As for the red birch it has been found to answer well for building and for furniture and implement purposes. A wool-press was seen at Gillow's Station in successful operation, that was entirely made of red birch; there were no straps or bands of iron to withstand the strain, every detail being of this timber. The size of the trees varies very much according to the situation and elevation. In the valley of the Waiau, near the sea, totaras were seen up to 27 feet in girth, and pines and birches close on 20 feet in girth; on the higher elevations a very usual size of the birch was from 1 to 2 feet in diameter.

*Barren Mountains.*—There are 1960 square miles under this division. All the country to the west of the Te Anau and Mani-

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\* Hooker in his 'New Zealand Flora,' classes as Beeches what are here termed Birches.

To the Red he gives the name 'Fagus Menziesii.'

Black    "       "    'Fagus Fusca.'

White   "       "    'Fagus Solandri.'

I have still used the term Birch, the tree being known in the Colony as such.

pori Lakes (with the exception of what is forest) comes under it. The higher parts of this country are composed of igneous rocks; from the numerous fractures that generally occur in them it may be expected that mineral and metallic veins will there exist. On Mount Pisgah several veins of quartz, with flakes of mica imbedded, were seen to traverse it; and in the valley of the Doon, below Mount Pisgah, there are many large fragments of quartz and granite. A very cursory examination was made of the bed of the Doon and several other of the streams west of the lakes; mica was discovered in abundance, but no auriferous deposits. Clay-slate and metamorphic rocks occur between the Te Anau and Wakatipu lakes, and minute particles of quartz are found on the Thomson Mountains. Up to the date of survey, this country had not been prospected; supposing that gold exists there, it is not likely to be come at so readily as was the case on the Shotover and Arrow, for the valleys are more open and wide than those of these rivers, and the alluvial deposits are much covered over with the degradation of the mountain sides. The higher parts of the Humboldt and Forbes Mountains seem, from their rounded massive forms, to be composed of granite. Mica-schist flanks the sides of the mountains surrounding the Shotover and Arrow; it is inclined at almost every angle, and is exceedingly friable in some instances; where it forms the escarpment of a ridge it presents a very contorted appearance. Standing on the Harris Mountains, and looking over to the Upper Shotover and around Murum, a wild, hacked, precipitous scene presents itself, to which it would be difficult to find a parallel.

*Means of Communication.*—In the open country of the Waiau districts, a packhorse may be taken up or down or across any part of it, and drays can also be taken over the greater part of it. There are two dray-tracks by which it communicates with other districts; one is by the Orawia and round the north side of Twinlaw, and is entirely in Southland; the other is by the valley of the Oreti. It enters Southland near the junction of the Windley and Oreti.

The means of communication in the Wakatipu district is mostly by water; the nature of the country necessitates this. All the valleys open into the lake, and then the shores of the lake are impassable in many places, so that the only way of getting from place to place is by boating. In the Shotover and Arrow districts the rivers flow through gorges too abrupt to allow of their courses being followed; the only way, therefore, of communicating with the upper parts of the district is by crossing over the ridges. The tracts over these are from 4000 to 6000 feet above the sea-level, and the ridges being much broken, a long detour is often necessary so as to keep on the leading ridge, or to get up or down a passable

spur; in this way several points on the Shotover and Arrow are reached by packhorses. Stores are congregated at these points, from whence supplies are distributed to the population along the river. The Wakatipu district has three routes of communication with country beyond its own boundaries; the principal is from Kingstown, at the south end of the lake, and this is the only part of the lake which drays can approach; the other two are bridle-tracks—one, from the west side of the lake, takes up the valley of the Von and continues on to the Te Anau Downs—the other leads over the ranges to the Cardrona and Upper Clutha Valleys. The position of Kingstown being at the end of the lake nearest the producing districts of the Colony, and the ports of the east coast, gives to it the command of the import trade of the lake. The magnitude of this trade has made the consideration of the means of communication with the Wakatipu districts a matter of primary importance. The impracticable nature of the Kawarau Valley as it now is, the nearness of the ports of Southland, and the lie of the country between them and the Wakatipu plainly point to them as the possessors of the greatest natural facilities for communication between the east coast and Kingstown. A dray-road by the Kawarau would, under present circumstances, be more than a rival to the route by Kingstown; but before a road could be formed and made, it is not unlikely that Southland will have so much improved the means of communication towards Kingstown, that goods will then be delivered as cheaply there as they ever can be at the Kawarau Junction; in this case, then, the proposed route would only be a rival to the one now in use. The difficulties to be overcome in the formation of a road along the Kawarau Valley are of no mean order; the river runs through a most precipitous gorge for 18 miles; opposite the confluence of the Nevis a mile or two would be saved on the length of road-line, but generally it would have to keep close on the river. An amount of side-cutting, bridging, &c., will have to be done before a substantial road is made, that, plainly, will make the cost per mile something great.

The known resources of the Wakatipu districts are forest, pastoral and agricultural lands, and auriferous deposits. The first three resources are so limited in quantity as to create little or no traffic to and from the district; it would, therefore, devolve almost entirely on the mineral resources of the district to support the road. Gold had been found up to the date of the survey over 600 square miles of country; the extent of country found to be payable, and from which the escort returns have come, extends over 360 square miles. The boundary line of this country describes a parallelogram; the north boundary is a line drawn from the head of the Wakatipu Lake, east, to the source of the Arrow on Mount Hyde;

the eastern boundary is a line from the source of the Arrow to its junction with the Kawarau; then for the remaining boundary lines, follow up the Kawarau to the lake, and then up the east side of the lake to its head; every creek within this extent, with only one or two exceptions, has been proved to be highly auriferous. The nearness of the Wakatipu gold-fields to the west coast suggests the mention of a route to it. The distance between the head of the Wakatipu Lake and the head of Milford Sound is only 27 miles; the mountain-ridges lie diagonally across the direct line between these two points; the height and abruptness of the ridges preclude the possibility of taking a direct course over them. The only way of traversing this, and, indeed, all the country bordering on the west coast, is to follow up the rivers to one or other of their sources, where generally there is a lower and more accessible part in the ridge over which a pass may be sought. The rivers are a greater hindrance in crossing this country than the mountains. In following them up, their channels are, as a rule, the only place available as a track; this of course necessitates the frequent fording of the river. Supposing, in the case of the west coast, there were really a good pass through the mountains, I believe that the rivers alone would so often interrupt traffic by their floods, that, practically considered, a route to the west coast is a thing not to be expected. At the very best, a bridle-track is all that may be hoped for. From these statements it follows as a sort of corollary, that the traffic of the country must follow the run of the rivers, and that therefore the eastern coast of the province is where the ports will ever be situated that command the interior districts.

I will conclude this Report by stating my belief that the extent of the pastoral and agricultural portion of the province has now been determined. The distance between the most westerly points of this survey and the coast-line is only a few miles; the great altitude of these points—the altitudes by Captain Stokes near the coast-line—the lie of the country and its appearance as actually seen, leave little doubt in my mind as to the utter barrenness of the region extending between the forests of the Wanaka, Wakatipu, Te Anau, and Manipori Lakes on the one side and the forests of the west coast on the other. To the south of this there is a considerable breadth of country to the west of the Princess Mountains as yet unexplored. What I saw of this country over the Howloko Lake consisted of undulating ridges covered with forest. Its exploration would have to be conducted from Preservation Inlet, or some of the other neighbouring inlets of the west coast.

Appended are Tables of areas, altitudes, and the register of the thermometer during the survey.

TABLE A.—ESTIMATED AREAS OF THE NATURAL DIVISIONS SURVEYED.

*Pasture.*

DISTRICTS.	LOCALITIES.	Area in Square Miles.	
Waiau .. ..	Open country on the west side of the Waiau River .. .. .	86	778·5
	Te Anau Downs, and the parts of the Mararoa and Oreti Valleys north of boundary line	387	
	Hodge's Run .. .. .	41	
	Paddocks east side of Te Anau Lake .. ..	1·5	
	The pastoral part of Southland, between the Takitimo Mountains and Waiau River ..	263	
Wakatipu ..	Valleys of the McKellar and Caples branches of the Greenstone River .. .. .	8	552·3
	Von Valley, and side of Wakatipu Lake between mouth of Greenstone and mouth of Afton Burn .. .. .	128	
	Along margin of Lake, between Afton Burn and Half-way Bay .. .. .	41	
	Valleys of Dart and Rees, and down east side of Lake to Fortune Cove .. .. .	91	
	Islands in Lake .. .. .	1·3	
	Country along the Lake between Fortune Cove and Queenstown, also along the north bank of the Kawarau, and up the valleys of the Shotover and the Arrow .. .. .	149	
	Along the east side of the Lake, between Queenstown and Kingstown .. .. .	67	
	Between Kingstown and the Mataura River, also the spurs of the Eyre Mountains drained by the Robert and Allen Creeks ..	67	
South-Eastern	Wakaia Valley .. .. .	..	305
	Total area .. .. .	..	1635·8

*Forests.*

	Sq. Miles.		Sq. Miles.
Dean .. .. .	307	Brought forward .. ..	858·7
Southland .. .. .	4·5	Windley Creek .. ..	12
Titiroa .. .. .	104	Ashton Burn .. ..	1·5
West of Manipori and Te Anau } Lakes .. .. .	186	Long Forest .. ..	9
Eglinton .. .. .	36	Greenstone River .. ..	8
Dunton .. .. .	208	Dart .. .. .	37
Burwood .. .. .	3·6	Rees .. .. .	4
Margin .. .. .	3·6	Miscellaneous .. ..	1
Bald Hill .. .. .	6	Wakaia .. .. .	26
		Total .. .. .	959·2
Carry forward .. ..	858·7		
Carried forward .. ..			2595·0

						Sq. Miles.	2595·0	
Brought forward .. .. .								
<i>Lakes.</i>								
						Sq. Miles.		
Te Anau .. .. .					132·5	Brought forward .. .. .	208·7	
Manipori .. .. .					49·7	Wakatipu .. .. .	113·6	
Howloko .. .. .					11	Hayes .. .. .	1·15	
Monowai .. .. .					10·5	Diamond .. .. .	'85	
Mavora (North and South) ..					5	Moke, Sylvan, Bog, &c. ..	1	
Carry forward .. .. .						208·7	Total .. .. .	325·3
Swamp .. .. .								3
<i>Barren.</i>								
						Sq. Miles.		
Longridge Mountains .. ..					34	Brought forward .. ..	710	
Princess do. .. ..					47	Eyre Mountains .. ..	215	
Billow do. .. ..					44	Thomson do. .. ..	42	
Hunter do. .. ..					102	Livingstone do. .. ..	144	
Matterhorn do. .. ..					22	Hector do. .. ..	47	
Kepler do. .. ..					97	Ailsa do. .. ..	33	
Murchison do. .. ..					133	Humboldt do. .. ..	73	
Barrier do. .. ..					20	Forbes do. .. ..	84	
Stuart do. .. ..					57	Takitimo do. .. ..	36	
Franklin do. .. ..					56	Richardson do. .. ..	318	
Castle do. .. ..					42	Garvie and Umbrella do. ..	164	
Earl do. .. ..					56	Harris do. .. ..	87	
Carry forward .. .. .						710	Dart (channel of river) ..	7
							Total .. .. .	1960
Total extent of country surveyed .. .. .								4883·3

TABLE B.—ALTITUDE OF PRINCIPAL OBJECTS IN FEET ABOVE SEA-LEVEL.

Earnslaw .. .. .	9200	Cecil Peak .. .. .	6477
Do .. .. .	9165	Symmetry Peaks .. .. .	6350
Mount Christina .. .. .	8475	Do. .. .. .	6224
Edward Peak .. .. .	8459	Mount Anau .. .. .	6294
Centaur Peaks .. .. .	8284	Mount Turnbull .. .. .	6283
Mount Ansted .. .. .	8157	Mount Crichton .. .. .	6185
Mount Tyndall .. .. .	8116	Mount Lyall .. .. .	6097
Mount Bonpland .. .. .	8102	Mount Eglinton .. .. .	6085
Cosmos Peak .. .. .	(?) 8000	Mount Dick .. .. .	6020
Mount Larkins .. .. .	7432	Rough Peaks .. .. .	6002
Mount Aurum .. .. .	7322	Do. .. .. .	5907
Stone Peak .. .. .	7222	Skelmorlie Peak .. .. .	5933
Humboldt Ridge .. .. .	7140	Countess Peak .. .. .	5928
Bold Peak .. .. .	6990	Hummock Peak .. .. .	5984
James Peak .. .. .	6898	Walter Peak .. .. .	5956
The Castle Mount .. .. .	6872	Helen Peaks .. .. .	5923
Moffat Peak .. .. .	6840	Do. .. .. .	5921
David Peaks .. .. .	6802	Mount Owen .. .. .	5806
Upper Peak .. .. .	6748	Round Peaks .. .. .	5794
Temple Peak .. .. .	6731	Do. .. .. .	5780
Mount Hyde .. .. .	6700	Ben Lomond .. .. .	5747
Jane Peak .. .. .	6650	Mount Soho .. .. .	5743
Stair Peak .. .. .	6644	Advance Peak .. .. .	5740
Mount Mavora .. .. .	6590	Winton Peak .. .. .	5759
Diana Peak .. .. .	6530	Mount Kane .. .. .	5740

TABLE B.—*continued.*

Flat Mount .. .. .	5711	Billow Mountains .. .. .	4884
Mount M'Dougall .. .. .	5667	Do. .. .. .	4041
Black Cone .. .. .	5665	Leaning Peak .. .. .	4858
Titiroa .. .. .	5643	Mount Nicholas .. .. .	4827
Caroline Peak .. .. .	5599	Mount Luxmore .. .. .	4811
Mount Campbell .. .. .	5593	Do. .. .. .	4563
Spire Peak .. .. .	5587	Steeple .. .. .	4800
Brunel Peaks .. .. .	5559	Alice Peak .. .. .	4734
Do. .. .. .	5390	Beatrice Peaks .. .. .	4715
Do. .. .. .	5170	Do. .. .. .	4528
Largs Peak .. .. .	5555	Dana Peaks .. .. .	4684
Bay Peaks .. .. .	5494	Precipice Peak .. .. .	4635
Mount Richmond .. .. .	5491	Tower Peak .. .. .	4627
Mount Eldon .. .. .	5470	Hook Peak .. .. .	4615
The Coronet .. .. .	5413	Steep Peak .. .. .	4481
Mount Burns .. .. .	5402	Forward Peak .. .. .	4421
Mount Pisgah .. .. .	5345	Mount Alfred .. .. .	4412
Lorn Peak .. .. .	5340	East Dome .. .. .	4440
Family Peaks .. .. .	5357	Turret Peaks (highest part) .. .. .	4373
Do. .. .. .	5220	Do. .. .. .	4135
Do. .. .. .	5187	End Peak .. .. .	4116
Do. .. .. .	5117	Titan Rocks .. .. .	4068
Brown Peaks .. .. .	5356	Hindley .. .. .	4050
Do. .. .. .	5285	Ardeer Peak .. .. .	3670
Do. .. .. .	5085	Long Ridge (highest part) .. .. .	3565
Cold Peak .. .. .	5342	Knoll Peak .. .. .	3548
Telford Peak .. .. .	5288	Edge Peak .. .. .	3483
Eldrig Peak .. .. .	5237	Oblong Hill .. .. .	3258
Jackson Peaks .. .. .	5237	Mount Prospect .. .. .	3246
Do. .. .. .	4738	Craigie Hill .. .. .	2808
Do. .. .. .	4236	Peninsula Hill .. .. .	2768
Bayonet Peak .. .. .	5213	Dean Hill .. .. .	2661
Snowdon .. .. .	5208	Highest part of Bridle Track between Te Anau Downs and Wakatipu Lake .. .. .	2615
Howitt Peaks .. .. .	5178	Helmet Hill .. .. .	2050
Cleughearn .. .. .	5156	Hamilton's Station .. .. .	2010
Barrier Peaks .. .. .	5161	Twinlaw .. .. .	1874
Do. .. .. .	5087	The Beehive .. .. .	1964
Do. .. .. .	5013	The Monument .. .. .	1543
Excelsior Peak .. .. .	5114	Mount York .. .. .	1344
Annick Peak .. .. .	5114	Pigeon Island .. .. .	1564
Cathedral Peak .. .. .	5134	Fern Hill .. .. .	1165
Mount Maury .. .. .	5090	Freestone Hill .. .. .	1107
Afton Peak .. .. .	5043	Hankinson's Station .. .. .	1125
Alexandra Peak .. .. .	5046	Gillow's Station .. .. .	1066
Albert-Edward Peak .. .. .	5030	Ridge between Lill Burn and Bryce Burn .. .. .	780
Miller Peak .. .. .	4995	View Hill .. .. .	727
Flecked Peak .. .. .	4953	Cox and Shad's Station .. .. .	490
Mount Hamilton .. .. .	4932	Lill Burn Valley, near junction of Hindley and Ardeer branches .. .. .	400
Halfway Peak .. .. .	4930		
Corner Peak .. .. .	4890		
Dunton Peaks .. .. .	4893		
Do. .. .. .	4834		
Cone Peak .. .. .	4875		

ALTITUDE OF LAKES.

North Mavora Lake .. .. .	2073	Te Anau .. .. .	694
Wakatipu .. .. .	1069	Manipori .. .. .	597

Howloko and Monowai not satisfactorily determined, but they may each be considered under 400 feet.

TABLE C.—REGISTER OF THE WEATHER.

Date.	Place.	Thermometer.		Remarks.
		7 A.M.	2 P.M.	
1862. Sept.				
8	Twinlaw .. ..	..	61	Strong west wind.
9	Do. .. ..	43	59	Do.
10	Do. .. ..	51	..	
..	Wairaki .. ..	..	81	Fine clear day.
11	Waiau .. ..	54	65	Dull and cloudy.
12	Howell's Station ..	50	53	Dull morning, rain in the afternoon.
13	Do. .. ..	49	54	Do. do.
14	Do. .. ..	39	60	Fine clear day.
15	Do. .. ..	31	56	Do.
16	Do. .. ..	42	..	
..	Lill Burn .. ..	..	65	Cloudy.
17	Do. .. ..	41	69	Clear.
18	Do. .. ..	43	61	Wet forenoon, clear afternoon.
19	Do. .. ..	38	80	Fine clear day.
20	Do. .. ..	50	75	Dull morning, clear afternoon.
21	Do. .. ..	58	61	Very wet day.
22	Do. .. ..	45	55	Do.
23	Do. .. ..	44	51	Dull forenoon, wet afternoon.
24	Do. .. ..	40	54	Do. do.
25	Do. .. ..	41	51	Very wet day.
26	Do. .. ..	46	61	Showery morning, dry afterwards.
27	Do. .. ..	44	71	Calm and cloudy.
28	Do. .. ..	50	96	Fine clear day.
29	Do. .. ..	51	56	Clear forenoon, wet afternoon.
30	Goldie Hill .. ..	42	55	Do. do.
Oct.				
1	Lill Burn .. ..	43	53	Showery.
2	Do. .. ..	45	56	Sunshine and shower.
3	Do. .. ..	46	56	Wet morning, clear afterwards.
4	Do. .. ..	50	67	Fine day, wet evening.
5	Do. .. ..	52	64	Fine clear day.
6	Do. .. ..	51	66	Dull and cloudy.
7	Do. .. ..	56	67	Dull, with showers.
8	Do. .. ..	39	60	Fine clear day.
9	Waiau .. ..	51	62	Wet forenoon, dry afternoon.
10	Do. .. ..	41	64	Dull and cloudy.
11	Do. .. ..	54	65	Do.
12	Do. .. ..	56	72	Fine clear day.
13	Do. .. ..	49	58	Showery.
14	Do. .. ..	44	62	Do.
15	Do. .. ..	50	58	Fine clear day.
16	Muscle Beach .. ..	51	68	Dull and showery.
17	Waiau .. ..	48	62	Fine.
18	Do. .. ..	60	67	Do.
19	Limestone Gorge ..	54	58	Very wet day.
20	Do. .. ..	42	53	Hail and snow.
21	Do. .. ..	39	56	Do.
22	Do. .. ..	39	57	Do.
23	Do. .. ..	48	60	Do.
24	Do. .. ..	43	67	Fine clear day.
25	Lill Burn .. ..	54	65	Do.
26	Limestone Gorge ..	52	68	Do.
27	Do. .. ..	51	..	

TABLE C.—continued.

Date.	Place.	Thermometer.		Remarks.
		7 A.M.	2 P.M.	
1862.				
Nov.				
27	Lill Burn .. ..	..	75	Fine clear day.
28	Howell's Station ..	54	74	Dull and cloudy.
29	Wairaki .. ..	54	68	Do.
30	Do. .. ..	51	70	Dull, but fine.
31	Do. .. ..	51	72	Do.
Nov.				
1	Waiau .. ..	58	81	Fine clear day.
2	Do. .. ..	56	71	Drizzling rain.
3	Do. .. ..	55	72	Foggy and dull.
4	Do. .. ..	53	..	
..	Takitimo .. ..	..	81	Dull, with n.w. breeze.
5	Do. .. ..	62	51	Wind from n.w.
6	Do. .. ..	54	..	
..	Waiau .. ..	..	57	Squalls from n.w.
7	Black Mountain ..	52	56	Squally showers from n.w.
8	Do. .. ..	60	57	Clear, with wind from s.w.
9	Do. .. ..	58	70	Dull, with showers.
10	Waiau .. ..	55	73	Fine clear day.
11	Do. .. ..	63	..	
..	Hindley .. ..	..	59	Do.
12	Do. .. ..	51	59	Fog in the forenoon, clear afternoon.
13	Do. .. ..	63	52	Do. do.
14	Do. .. ..	52	62	Dull and cloudy.
15	Waiau .. ..	59	70	Fine clear day.
16	Do. .. ..	65	75	Do.
17	Do. .. ..	64	71	Do.
18	Do. .. ..	62	66	Wind from n.w. in the forenoon, showery afternoon.
19	Do. .. ..	64	..	
..	Takitimo .. ..	..	61	Dull and cloudy.
20	Excelsior Creek ..	59	..	
..	Takitimo .. ..	..	60	Do.
21	Mararoa .. ..	61	64	Cloudy forenoon, wet afterwards.
22	Do. .. ..	58	67	Dull, wind from n.w.
23	Do. .. ..	60	71	Do.
24	Do. .. ..	61	71	Do.
25	Do. .. ..	60	..	
..	Mount Prospect ..	..	56	Squally showers.
26	Mararoa .. ..	62	..	
..	Mount Prospect ..	..	76	Bright sunshine day.
27	Mararoa .. ..	57	84	Do.
28	Do. .. ..	60	75	Do.
29	Whitestone .. ..	65	69	Drizzling showers.
30	Do. .. ..	69	66	Wet forenoon, dull afternoon.
Dec.				
1	Do. .. ..	64	75	Drizzling rain and fog.
2	Do. .. ..	63	79	Fog in the forenoon, sunshine afternoon.
3	Do. .. ..	63	79	Sunshine and shower.
4	Manipori Lake ..	66	75	Sunshine at intervals
5	Do. .. ..	59	58	Wind from n.w., with ra.
6	Do. .. ..	44	60	Clear, wind from n.w.
7	Do. .. ..	50	61	Do.

TABLE C.—*continued.*

Date.	Place.	Thermometer.		Remarks.
		7 A.M.	2 P.M.	
1862.				
Dec.				
8	Manipori Lake .. ..	51	75	Clear, wind from N.W.
9	Do. .. ..	55	80	Fine clear day.
10	Do. .. ..	53	66	Do.
11	Do. .. ..	62	84	Fog in the morning; fine afterwards.
12	Do. .. ..	61	69	Wet morning, dry afterwards.
13	Do. .. ..	56	63	Very wet day.
14	Do. .. ..	59	64	Dull and showery.
15	Do. .. ..	60	69	Dull and cloudy.
16	Do. .. ..	57	71	Do.
17	Do. .. ..	60	77	Fine and clear.
18	Do. .. ..	61	78	Do.
19	Do. .. ..	63	84	Do.
20	Do. .. ..	57	..	Fog in the forenoon.
..	Te Anau .. ..	..	71	Clear afternoon.
21	Do. .. ..	60	83	Very fine.
22	Do. .. ..	62	65	Dull and cloudy.
23	Do. .. ..	65	68	Wet and stormy.
24	Do. .. ..	64	69	Strong wind from the N.W.
25	Do. .. ..	66	80	Clear, wind from N.W.
26	Do. .. ..	67	67	Wet and stormy.
27	Do. .. ..	66	67	Very wet.
28	Do. .. ..	62	71	Fine and clear.
29	Do. .. ..	64	74	Do.
30	Do. .. ..	69	75	Do.
31	Do. .. ..	59	65	Dull and cloudy.
1863.				
Jan.				
1	Do. .. ..	69	78	Do.
2	Do. .. ..	64	61	Do.
3	Do. .. ..	55	59	Do.
4	Do. .. ..	60	65	Dull forenoon, wet afterwards.
5	Mount Pissah .. ..	46	..	..
..	Te Anau .. ..	..	59	Do.
6	Te Anau Lake .. ..	54	58	Very wet day.
7	Do. .. ..	55	75	Fine clear day.
8	Do. .. ..	59	69	Dull and cloudy.
9	Do. .. ..	65	72	Do.
10	Do. .. ..	60	76	Fine and clear.
11	Do. .. ..	61	..	..
..	Mount Eglinton .. ..	..	69	Do.
12	Do. .. ..	53	..	..
..	Te Anau .. ..	..	66	Clear forenoon, dull afternoon.
13	Do. .. ..	58	72	Fine and clear.
14	Do. .. ..	69	76	Do.
15	Do. .. ..	68	98	Do.
16	Manipori .. ..	75	87	Do.
17	Upekerora .. ..	71	79	Dull and cloudy.
18	Do. .. ..	68	78	Do.
19	Do. .. ..	60	..	..
..	Whitestone .. ..	..	82	Dull forenoon, clear afternoon.
20	Do. .. ..	72	76	Dull and cloudy.
21	Do. .. ..	67	75	Drizzling rain.
22	Mararoa .. ..	62	78	Do.
23	Do. .. ..	61	74	Dull, and then clear.

TABLE C.—*continued.*

Date.	Place.	Thermometer.		Remarks.
		7 A.M.	2 P.M.	
1863.				
Jan.				
24	Oreti .. ..	61	84	Clear forenoon, wet afternoon.
25	Do. .. ..	65	75	Dull with showers.
26	Do. .. ..	64	74	Dull and cloudy.
27	Mararoa .. ..	65	..	
..	Bald Hill .. ..	..	63	Do.
28	Mararoa .. ..	60	..	
..	Bald Hill .. ..	..	48	Do.
29	Mararoa .. ..	54	..	
..	Mavora Lake .. ..	..	65	Dull morning, clear afternoon.
30	Do. .. ..	61	64	Wet day.
31	Do. .. ..	54	..	
..	Cold Peak .. ..	..	51	Dry and clear.
Feb.				
1	Mavora Lake .. ..	60	76	Do.
2	Do. .. ..	65	77	Drizzling rain.
3	Oreti .. ..	62	72	Strong wind from n.w.
4	Do. .. ..	64	74	Wet day.
5	Do. .. ..	65	71	Clear, wind from n.w.
6	Do. .. ..	54	69	Dull forenoon, wet afternoon.
7	Von River .. ..	59	70	Dull and cloudy.
8	Pond Burn .. ..	55	67	Clear.
9	Von River .. ..	55	66	Showery.
10	Wakatipu Lake .. ..	62	70	Dull and cloudy.
11	Do. .. ..	60	71	Do.
12	Do. .. ..	64	..	
..	Mount Nicholas .. ..	..	61	Do.
13	Wakatipu .. ..	60	..	
..	Mount Nicholas .. ..	..	47	Do.
14	Wakatipu .. ..	62	75	Fine and clear.
15	Do. .. ..	65	90	Do.
16	Do. .. ..	61	82	Dull and foggy.
17	Do. .. ..	68	89	Clear.
18	Rees River .. ..	62	72	Fine and clear.
19	Mount Alfred .. ..	68	84	Do.
20	Rees River .. ..	63	86	Do.
21	Dart River .. ..	66	83	Do.
22	Do. .. ..	53	83	Do.
23	Diamond Lake .. ..	69	..	
..	Rees River .. ..	..	86	Do.
24	Wakatipu .. ..	66	67	Very wet day.
25	Do. .. ..	65	78	Dull and cloudy.
26	Do. .. ..	67	78	Fine and clear.
27	Do. .. ..	65	85	Do.
28	Do. .. ..	62	72	Wet morning, dull after.
March.				
1	Do. .. ..	59	72	Fine and clear.
2	Do. .. ..	59	75	Do. wind from n.w.
3	Do. .. ..	60	75	Do. do.
4	Frankton .. ..	62	..	
..	Peninsula Hill .. ..	..	55	Dull forenoon, wet after.
5	Frankton .. ..	56	..	
..	Peninsula Hill .. ..	..	73	Dull forenoon, clear after.

TABLE C.—*continued.*

Date.	Place.	Thermometer.		Remarks.
		7 A.M.	2 P.M.	
1863.				
Jan.				
6	Frankton .. ..	52	..	
..	Shotover .. ..	..	84	Fine and clear.
7	Haye's Lake .. ..	64	80	Do.
8	Arrow River .. ..	61	81	Dull forenoon, clear afternoon.
9	Do. .. ..	68	69	Fine and clear.
10	Harris Mountains ..	54	52	Do.
11	Do. .. ..	32	46	Dull and cloudy.
12	Shotover .. ..	61	68	Fine sunshine.
13	Wakatipu .. ..	63	81	Do.
14	Queenstown .. ..	62	75	Do.
15	Ben Lomond .. ..	55	67	Dull and cloudy.
16	Do. .. ..	54	62	Dull forenoon, wet afternoon.
17	Wakatipu .. ..	53	79	Fine and clear.
18	Do. .. ..	62	77	Do.
19	Do. .. ..	58	64	Showery.
20	Do. .. ..	61	75	Do.
21	Eyre Mountains ..	63	68	Sunshine day.
22	Wakatipu .. ..	61	71	Very wet day.
23	Do. .. ..	52	73	Showery.
24	Do. .. ..	59	74	Dry and clear.
25	Kingstown .. ..	52	56	Showery.
26	Do. .. ..	56	68	Dry and clear.
27	Mount Dick .. ..	54	52	Dull.
28	Mataura .. ..	55	76	Dull forenoon, clear after.
29	Do. .. ..	56	81	Fine and clear.
30	Do. .. ..	51	65	Dull, with fog.
April.				
4	Wakaia .. ..	45	71	Fine and clear.
5	Do. .. ..	44	70	Do.
6	Do. .. ..	48	50	Wet and stormy.
7	Do. .. ..	39	52	Do.
8	Do. .. ..	47	66	Fine and clear.
9	Do. .. ..	50	65	Dull morning, wet after.
10	Do. .. ..	48	62	Fine.
11	Do. .. ..	34	66	Do.
12	Do. .. ..	42	63	Wet and cloudy.
13	Do. .. ..	31	67	Fine.
14	Do. .. ..	49	71	Do.
15	Do. .. ..	51	72	Do.

NOTE.—The bearings of the survey of the Waiau districts are from the true meridian of Mount York, lat.  $45^{\circ} 33' 23.4''$  s.; long.  $167^{\circ} 47' 58.6''$  E. of Greenwich. Reference bearing on true meridian to Mount Hamilton,  $105^{\circ} 47'$ . The datum-line for altitudes is the highwater-mark, Bluff Harbour. The bearings of the Wakatipu districts are from Mount Nicholas, lat.  $45^{\circ} 07' 24.3''$  s.; long.  $168^{\circ} 28'$  E. of Greenwich. Reference bearing on true meridian to the Crown,  $64^{\circ} 11'$ . The altitudes are with reference to Mount Pisa, 6426 feet—one of the elevations determined by

the Reconnaissance Survey of 1857-8. The Wakaia district has been plotted on the map of the south-eastern districts with reference to the positions of the Pyramid and East Dome, as laid down on it by Mr. Garvie. The altitudes are relative to the Black Umbrella, 3580 feet above sea-level, also determined by Mr. Garvie.

The distances throughout the survey were determined from bases measured twice by a common chain; artificial marks were set up till a length of 3 or more miles was obtained in the sides of the triangle, after that natural marks, such as mountain-peaks, edge of landslips, &c., were used as points for triangulation; where this was impracticable, then the method of converging angles was had recourse to. Up the Fiords of the Te Anau and Manipori Lakes, where, on account of the inaccessible nature of the mountains, and the shore-line being shaded over with foliage, neither a triangulation could be carried on, nor bases measured, differences of level between the lake and one or more commanding peaks were used as a base for determining distances. This method, from the rapidity it gave to the execution of the work, was found to be of great value under the circumstances. There was generally no difficulty in finding a suitable mountain-peak, a mile or so in vertical height above the level of the lake; the angle of elevation to which, after the necessary corrections had been applied, giving an excellent means of determining distances up to 7 or 8 miles. The bearings were (from the same reasons as rendered a vertical triangulation necessary) magnetic. Care was always taken on returning to the stations of the true meridian to observe if there was any local deviation in the variation of the compass. In every other part of the survey the work was done on the true meridian. The difference of bearing between the meridians of Mount York and Mount Nicholas was found to be 30'; the difference *to be added* to the meridian of Mount Nicholas. The difference of bearing between the meridians of Mount Nicholas and Lindis Peak 44', the difference *to be added* to the meridian of Lindis Peak. These differences are not to be taken as precise, seeing that the instrument had to be set several times to natural objects in taking on the bearings from meridian to meridian; but they may be taken as showing a general agreement throughout the survey as to bearing, for the apparent discrepancies are very nearly such as are accounted for by the convergence of the meridians to the Pole. The difference between the meridians of the Bluff and Mount York, obtained in a similar manner to the other differences, is 29', *to be added* to the meridian of the Bluff. In plotting the survey, the latitudes of the prime stations were found to close the one with the other, as also with the latitude of Mount Hamilton, as determined by the Reconnaissance Survey of Southland. A discrepancy of rather more than 1' of longitude,

or nearly 5" by chronometer, exists between the longitudinal positions of Mount Hamilton, as determined from the two surveys; as the discrepancy is one of absolute distance, it does not affect the value of either survey. The desirability of having a check on the chronometrical determination of the longitudes of meridians was kept in view during the survey by carrying on, with as much care as possible under the circumstances, a triangulation based on short lines. After plotting the work to the scale of one-half inch to the mile, it is satisfactory to state, considering the rugged nature of the country, that the difference between the chain and chronometrical measurements of the distance between Lindis Peak and Mount York was not appreciable; the meridian of Mount Nicholas when brought to the same test, shows a difference of  $2\frac{1}{2}$ " by chronometer.

To check the altitudes, several peaks were determined, both from the data of Mount Pisa and from the data of the Bluff. The nearest agreement of the two determinations was that of Earnslaw, the difference being only 2 feet. The greatest disparity was in the two determinations of Mount Nicholas, the difference being 107 feet. The angular measurements of the survey were all made (with the exception of the astronomical observations), by a 4-inch Everest theodolite. Throughout the survey, an equal attention was given to the details of each district; so that unnecessary minuteness was not obtained in one part at the expense of vagueness in another.

V.—*An Exploration up the Moisie River, to the Edge of the Table-land of the Labrador Peninsula.* By HENRY YOULE  
HIND, M.A., F.R.G.S., Trinity College, Toronto.

*Read, January 25, 1864.*

THE Moisie River has for centuries been the canoe-route of the Montagnais tribe of Indians from the Gulf of St. Lawrence to the interior of the Labrador peninsula; and within the last fifteen years this river has formed the route by which a few families of the Nasquapee Indians, whose hunting-grounds lie on the table-land, have reached the gulf. The mouth of the Moisie is about 18 miles east of the well-known Bay of Seven Islands; and, as the general direction of its course is very nearly due north, it forms, probably, the shortest route by which the table-land can be reached from this part of the gulf. It has also this advantage, that the north-east branch is separated by a very low water-parting from the head-waters of the Ashwanipi, or Hamilton River, the great river of the table-land, which, after a course of about 400 miles, empties into Hamilton Inlet, and forms an inland canoe-route, in